10/501,148
07/13/04

PCT/GB 2003 / 0 0 0 1 9 4

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Dated 6 February 2003

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1/77

07NOV02 E761581-1 C81053
P01/7700 0.00-0225939.8

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NP10 8QQ

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

07 NOV 2002

1. Your reference

EAT PAT 7

2. Patent application number
(The Patent Office will fill in this part)

0225939.8

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

E.A. TECHNICAL SERVICES Ltd
9 RYDAL PLACE
CLITHEROE ROAD
CLITHEROE
LANCASHIRE
BB7 4JY

Patents ADP number *(if you know it)*

8306474001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

COMPRESSOR WITH VARIABLE PRESSURE AND FLOW CONTROL

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Patents ADP number *(if you know it)*

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
UK	0200991.8	17.1.02

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
~~0200991.8~~	N/D

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) *any applicant named in part 3 is not an inventor, or*
b) *there is an inventor who is not named as an applicant, or*
c) *any named applicant is a corporate body.*

See note (d))

YES

Patents Form 1/77

Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	2 ✓
Claim(s)	0
Abstract	0
Drawing(s)	TO 9 ONLY RN

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	10 figures included in 9 Drawings

11. I/We request the grant of a patent on the basis of this application.

Signature R W Driver Date 6 NOV 02

12. Name and daytime telephone number of person to contact in the United Kingdom RON DRIVER 01200 441492

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

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e) *Once you have filled in the form you must remember to sign and date it.*

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Compressor with Variable Pressure and Flow Control

Over the past few years hybrid engines have been proposed that were a combination of electric motor and a relatively small engine running at near maximum power whenever it was used. More recently there has been a move to a higher voltage electrical system, this permits engines to stop when the vehicle stops and then for the vehicle to initially move off using the electric motor.

In the present invention it is proposed to use a combination of supercharger, internal combustion engine and exhaust turbine. The exhaust turbine may drive a compressor or electrical generator or both. The enabling technology to permit efficient use of this combination of components is the use of a supercharger of the type and incorporating a combination of compatible features described in application PCT/GB01/03089 and 0200991.8 and 0211603.6 and 0216084.4 and 0222776.7 and GB2364552 and the features described in the present invention. This type of supercharger allows the internal combustion engine's airflow to be controlled. It takes a full charge of air each revolution and evacuates air not required by pushing it out through the side disc metering orifice or orifices and allows the remainder to be discharged to the engine. In this manner the supercharger can supply air from ambient pressure to maximum supercharge pressure. This type of supercharger has compression efficiency comparable with the efficiency of the compression within an engine and an ability to accurately control airflow and is applicable to diesel engine charging and exhaust gas treatment and to the pressurising and expansion of fuel cell environments.

In PCT/GB01/03089 and 0200991.8 and 0211603.6 and 0216084.4 and 0222776.7 and GB2364552 the position of the rotating piston in relation to the hinging vane was always changing and a single point on the piston was always sweeping the bore of the casing or the tip of the vane. The leakage of fluid between the casing and piston was controlled by the gap between the two parts and the circumferential length of the gap and the effectiveness of any labyrinth seal. The leakage between the hinging vane and the piston was controlled largely by the gap and circumferential length of the gap. The circumferential length of gap between the hinging vane and piston was small compared to the circumferential length of the gap between the casing and piston because the vane tip radius curved in the opposite direction to the piston surface whereas the casing radius curved in the same direction as the piston surface. The size of the minimum gap between the piston and the casing and vane was determined by the need to allow for thermal expansion and for deflections caused by mechanism operational stresses. It was desirable to find a way of increasing the circumferential length of the gap between the vane and piston and to mitigate the effects of thermal and mechanism load deflections.

In the present invention the part of the rotating piston that would have been in close proximity to the casing and vane is reduced in diameter and to the reduced diameter piston is fitted a bearing and to the outer diameter of the bearing is fitted a ring and a fixed appendage to the ring is attached to the vane. A bearing allows the attachment of ring and vane to pivot in relation to each other. Because the vane and ring are allowed to pivot in relation to each other the ring can be shaped in the local area of the vane to provide a substantial circumferential gap length between the vane and ring. The gap between the ring and casing is substantially unchanged by fitting the bearing and ring

although creating a labyrinth seal over the whole of the ring's circumference is likely to reduce leakage between ring and casing. In addition, or as an alternative to a labyrinth seal the ring's outer surface could be coated with a compliant material. The compliant coating could be rubber like the tyres of vehicles. The amount of differential thermal expansion and mechanical stress deflection is likely to be less than 200 microns therefore a compliant coating that could be compressed by this amount would be sufficient; components could be assembled with this built in compression.
The present invention with bearing and ring attached to the vane produces a rolling motion between the ring and casing, and mechanical losses associated with this motion are like the rolling resistance losses of a wheel and are caused by the cyclic compression of the compliant coating. These losses are small compared to the gain in efficiency made by the reduced leakage. The relationship between the vane tip and ring is a sliding motion and will provide some friction if there is not a positive clearance; the increased circumferential length of the gap and the possibility of providing a labyrinth seal at this point will substantially reduce leakage at this point.

The invention may be performed in various ways and some specific embodiments will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

Fig 1 shows a ring with fixed appendage and local conforming vane tip curve
Fig 2 shows a vane
Fig 3 shows an assembly of ring and vane.
Fig 4 shows a piston with one disc removed.
Fig 5 shows an assembly of vane, ring, piston and ring bearing.
Fig 6 shows an assembly as Fig 5 with the casing fitted.
Fig 7 shows the piston with both side discs.
Fig 8 shows an assembly as Fig 6 with both side discs and end covers fitted.
Fig 9 shows how two units could be arranged in relationship to each other.
Fig 10 shows two units in an alternative arrangement to Fig 9.

With the piston rotating as shown in Fig 5 the closest position of the ring to casing bore rotates with the piston, the ring is constrained by its attachment to the vane to move within the limits defined by the vane pivoting about its attachment to the casing and the centre of the offset axis of the rotating piston.
Fig 9 shows a configuration of two units where the pivoting vane for both units can be one component and the reactions from the movement of both rings acting on a single bearing attachment to the casing cancel each other and substantially reduce the bearing stresses. Fig 10 is an alternative arrangement of two units where vane to casing pivot bearing stresses are higher than those in Fig 9.

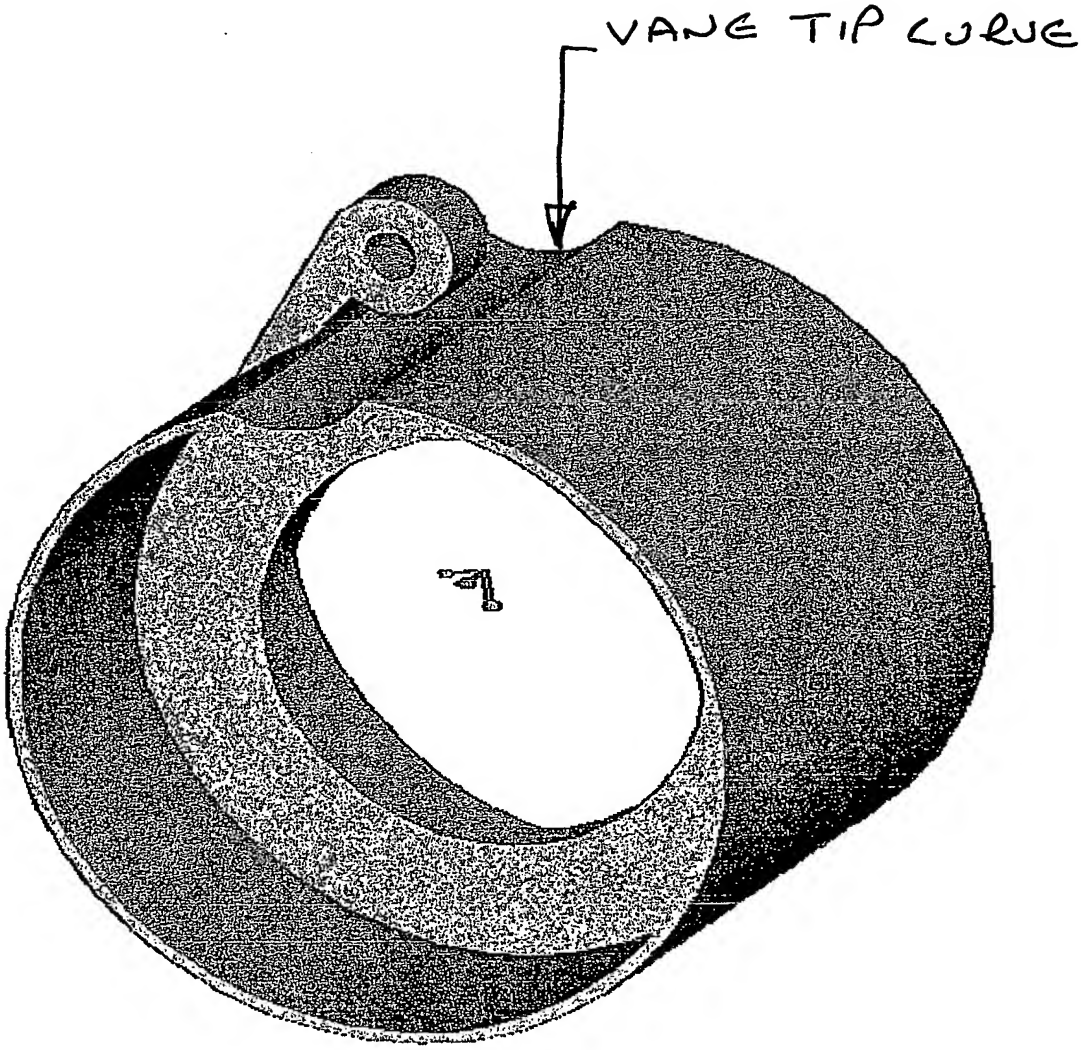

FIG 1

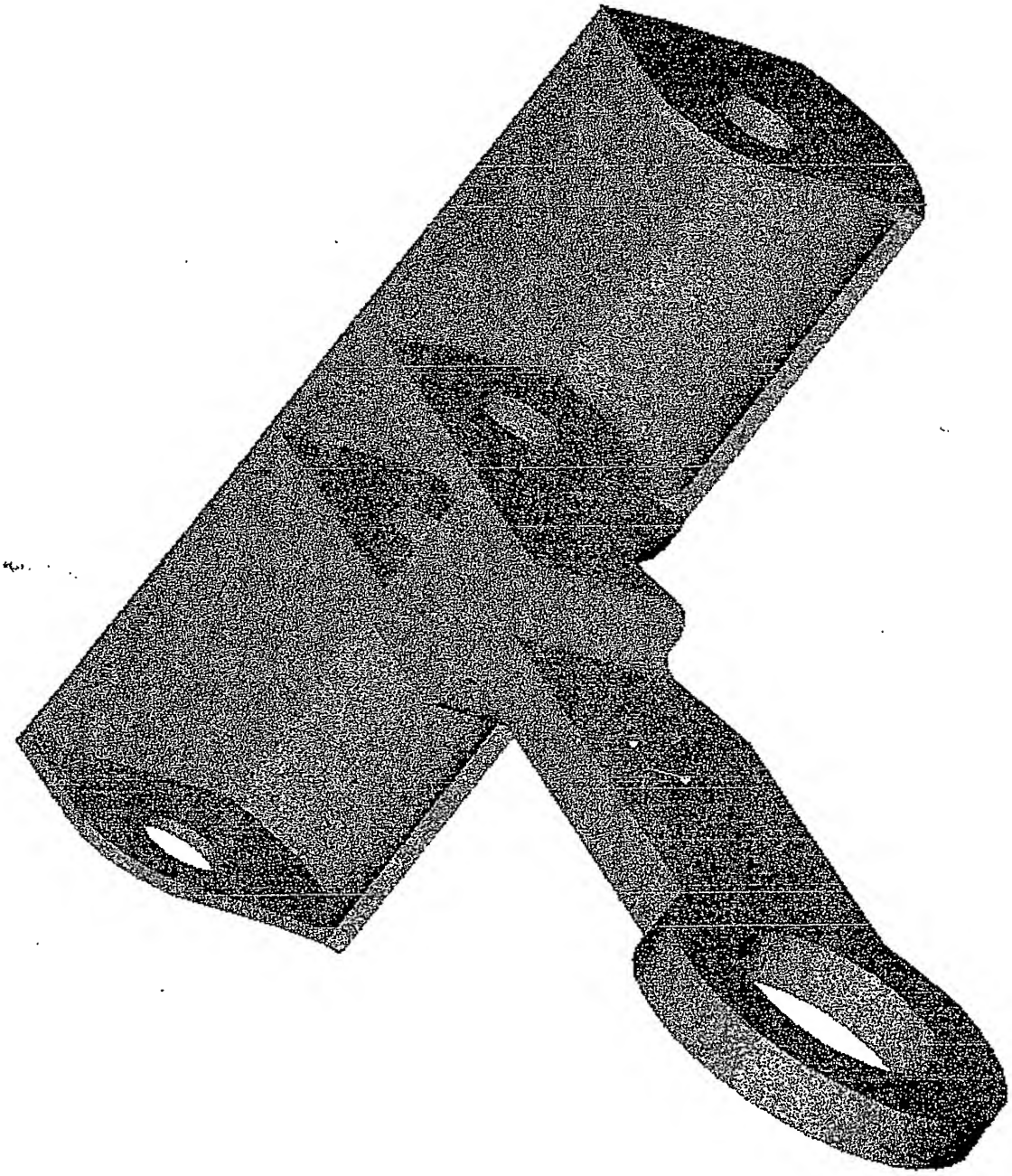

FIG 2

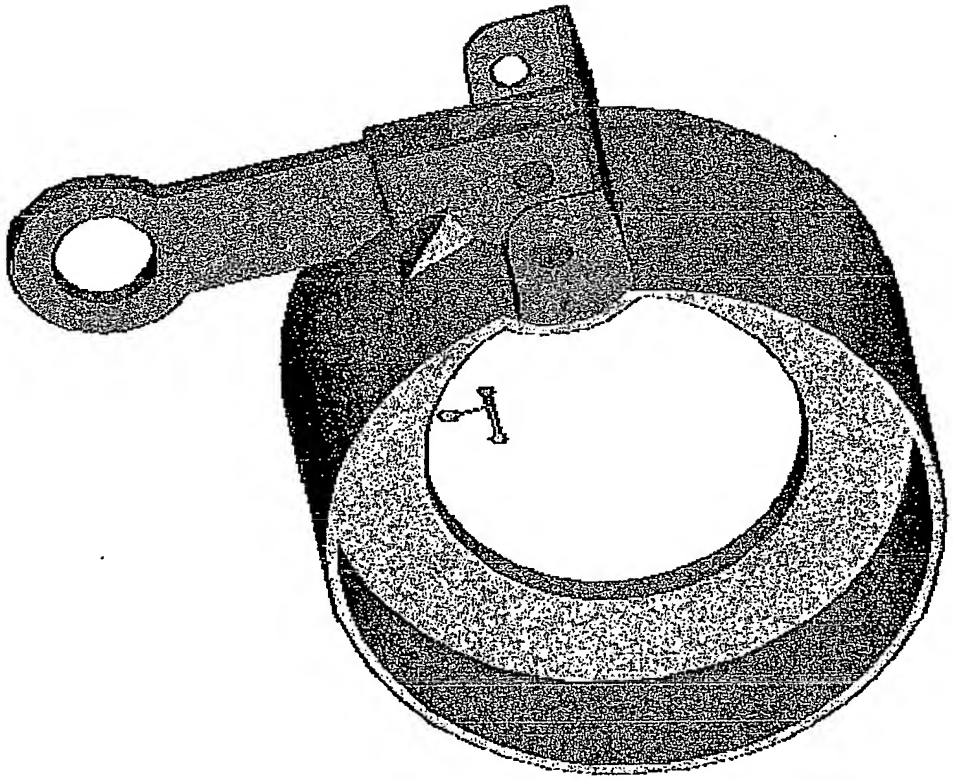

FIG 3

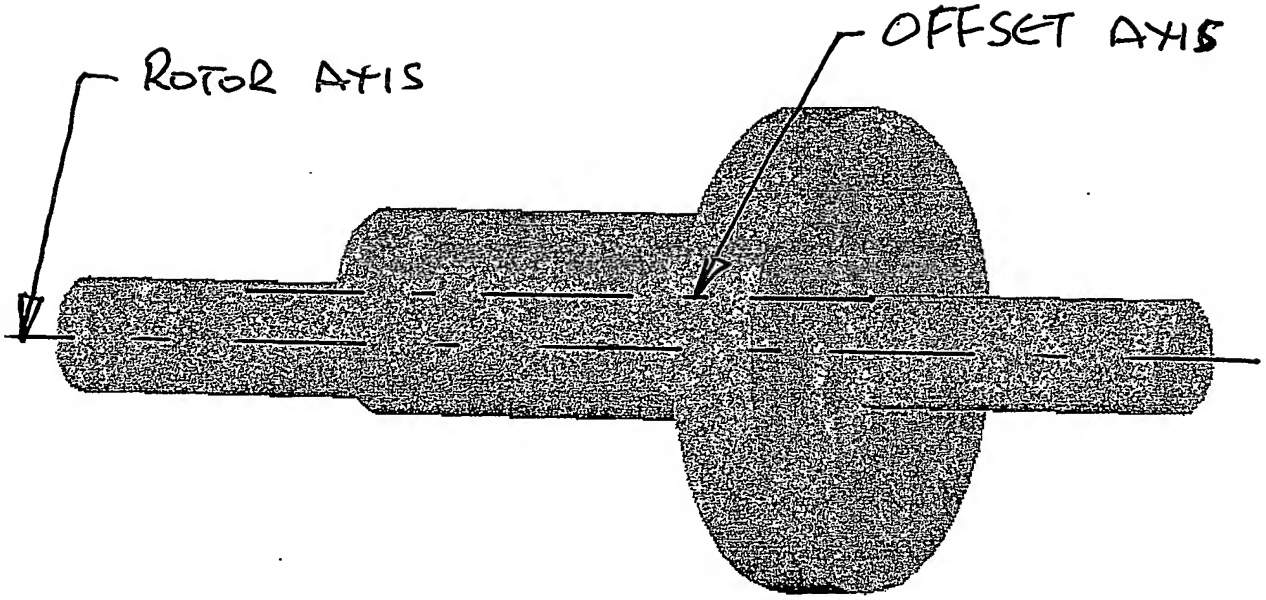

FIG 4

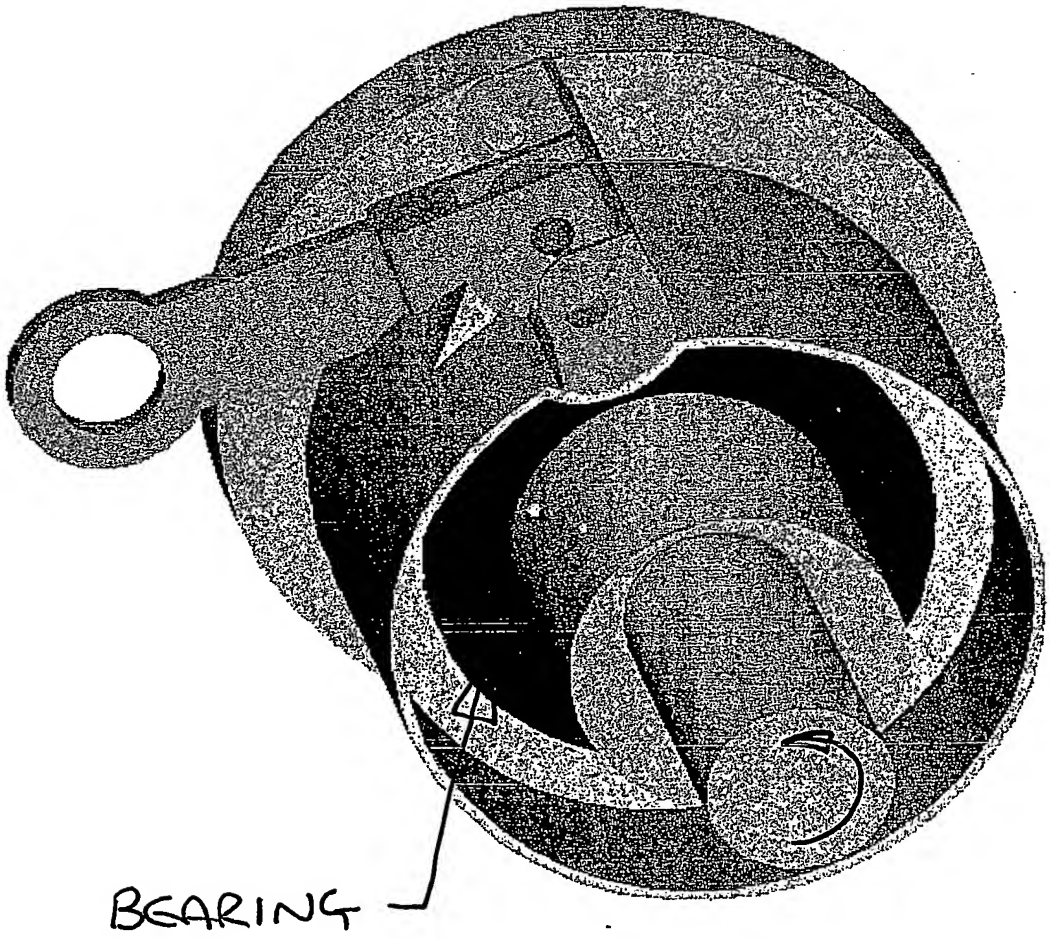

FIG 5

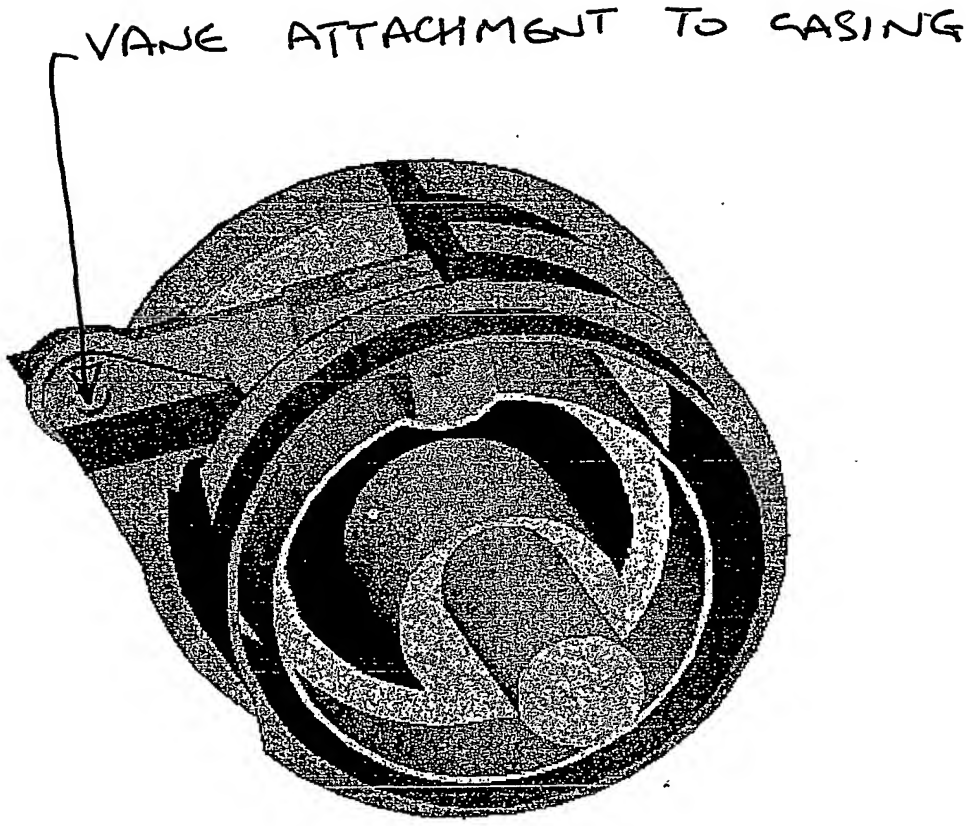

FIG 6

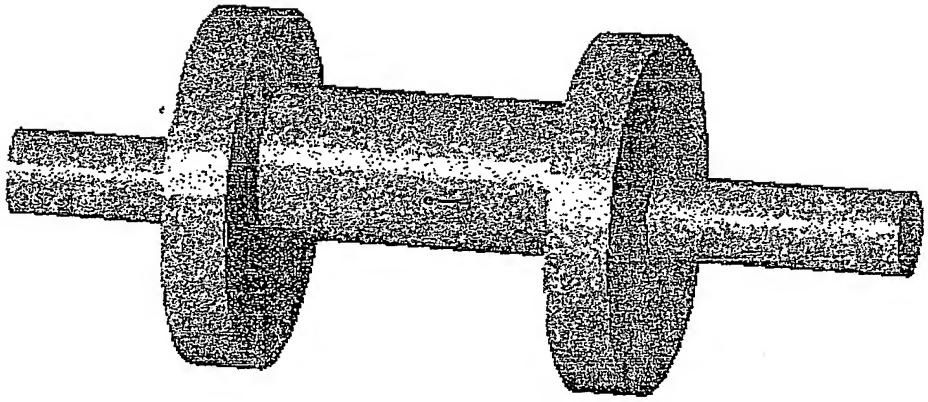

FIG 7

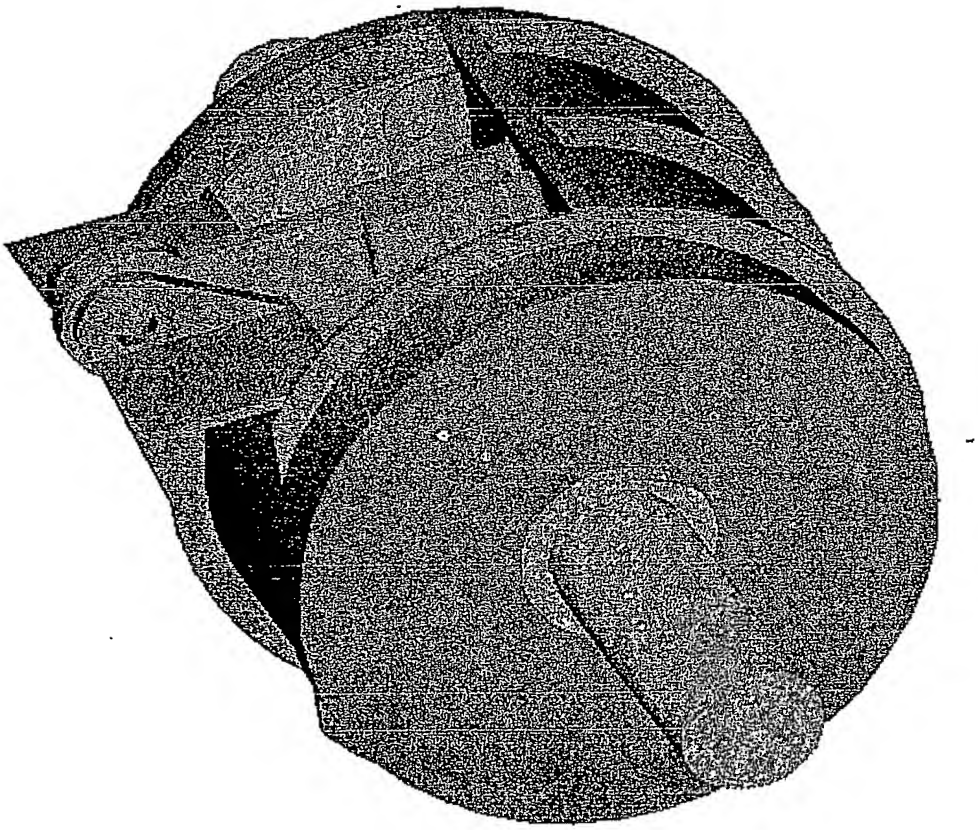

FIG 8

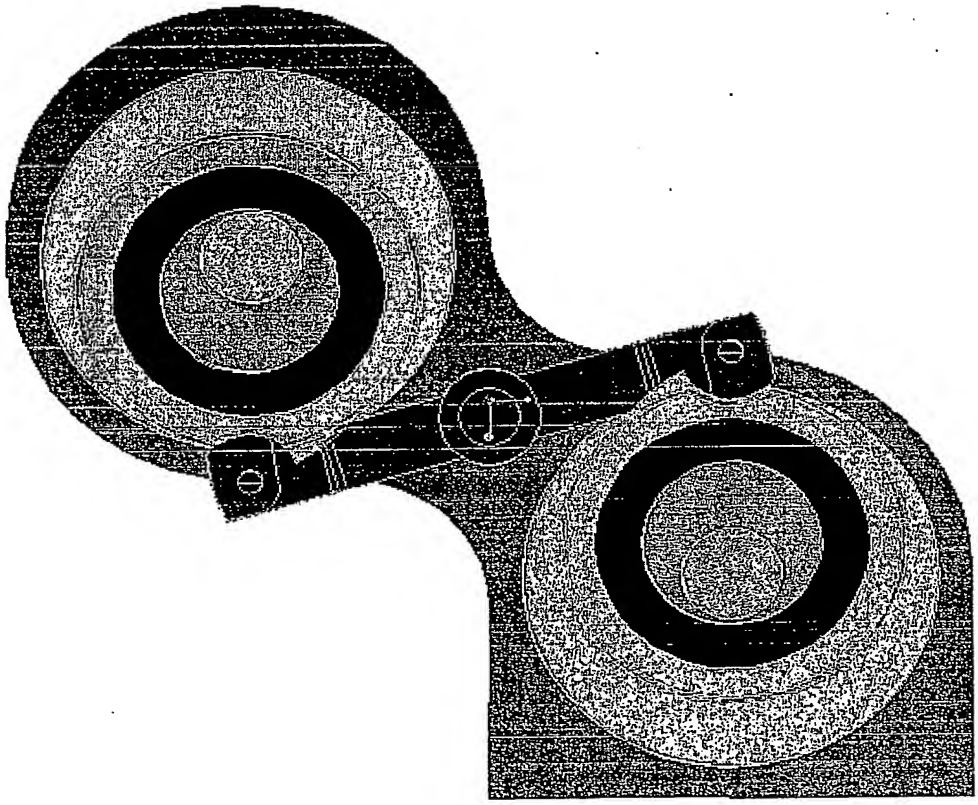

FIG 9

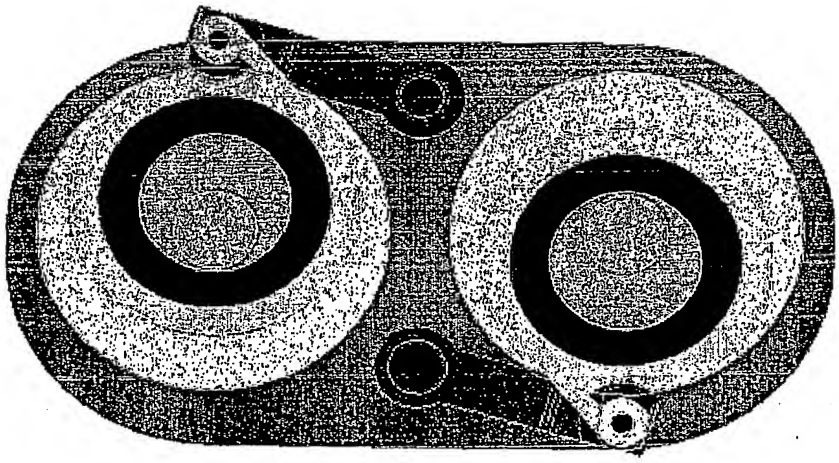

FIG 10